



Final Report
of the
Telecommunications Systems Survivability (TSS)
Task Force

**Telecommunications Systems
Survivability**

Assessment and Future Directions

May 2, 1989

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1.0 TELECOMMUNICATIONS SURVIVABILITY

In this final report, the Telecommunications Systems Survivability (TSS) Task Force distills its view on the evolving status of TSS, in the light of knowledge gained of vulnerabilities and of Government plans and acquisitions to counter those vulnerabilities. The report also offers proposals for future actions. The Task Force was originally charged to review past survivability activities in support of National Security Emergency Preparedness (NSEP) telecommunications and identify gaps and overlaps in overall treatment. A more recent charge was to study new technologies applicability to NSEP telecommunications survivability.

The Task Force, in assessing NSEP telecommunications survivability overall, distinguishes two situations:

Non-nuclear emergencies. The TSS Task Force regards telecommunications as inherently robust in all emergency situations short of nuclear war. The industry has had extensive experience in handling loss and damage due to earthquakes, fire, and flood. It is felt, in the advent of conventional war-related crises, the richness and redundancy of the telecommunications infrastructure would cushion the impact of most losses, even assuming coordinated attacks on individual telecommunication sites. This is not to say there would be no traffic flow impairment resulting from major congestion in tandem networks, and limited geographical impacts would occur if local serving entities are disabled.*

Reconstitution after nuclear attack. In the event of nuclear war, damage to telecommunications along with many other infrastructure systems would be extensive. The Government has embarked on a national level program** to fund public switched network (PSN) enhancements that will assist in reconstitution of an NSEP network following nuclear laydown. This investment is reasonable and prudent, and should be continued. In any event, telecommunications appears at least as survivable as other systems critical for life support such as transportation, the distribution of food and medical supplies, and the like.

The main vulnerability of the telecommunications system is seen to be its dependence upon commercially available electric power.

*Reduced susceptibility of the networks to both impairments is achievable, especially by application of new and emerging technologies. The industry focuses on operations in naturally occurring conditions. The Government focuses on providing national security preparedness in a range of wartime and other scenarios. These two views should be integrated.

** The National Level National Security Emergency Preparedness Telecommunications Program currently includes three elements: Commercial SATCOM Interconnectivity (CSI), Commercial Network Survivability (CNS), and Nationwide Emergency Telecommunications Service (NETS) programs.

2.0 BACKGROUND

In the early 1980s, the Government questioned whether, in times of emergency such as war, damage to public switched networks would deny adequate telecommunications to support vital national security functions. This concern was identified in 1982 for the attention of the National Security Telecommunications Advisory Committee (NSTAC). The NSTAC provides telecommunications industry advice to the President to support the Government's efforts to provide for National Security Emergency Preparedness.

The NSTAC undertook to address the TSS issue piece by piece. Over the years, task forces and other groups have studied and made recommendations in specific survivability-related issue areas: e.g., the survivability of commercial satellite telecommunications and the terrestrial segment of commercial telecommunications; the need for national coordination; and the requirement for provisioning of commercially available electric power or the distribution of fuel for continuing backup power operations.

In many cases basing their action on the NSTAC recommendations, the Government, as well, has moved forward in these survivability arenas.

In early 1986, the NSTAC's Industry Executive Subcommittee (IES) established a TSS Task Force to review the full scope of telecommunications systems survivability-related issues and make further recommendations. The Task Force initiated a review that extended to five survivability-related issue areas, and developed conclusions and recommendations in interim reports for each issue area as it was addressed. The Task Force next addressed all five areas at a more general level and documented results and recommendations in a report endorsed by the NSTAC in July 1988*. It subsequently focused more intensively on considering the impact that new and emerging technologies could have on Government planning for survivable NSEP telecommunications.

3.0 TSS TASK FORCE ACCOMPLISHMENTS AND VIEWS

In fulfilling its charge to review survivability issues, besides achieving increasing awareness and a "global" view of telecommunications systems survivability, the TSS Task Force has:

- o Elevated to the level of Presidential concern the criticality of power for telecommunications so that the NSTAC in conjunction with the Department of Energy is now addressing the interdependence of telecommunications and energy

*Review of Government Actions in Response to NSTAC-Recommended Initiatives, June 1988. Vol. I includes revised summary treatment of individual issue areas plus overall findings, conclusions, and recommendations. Vol. II contains the initial reports on specific issue areas.

- o Examined the issue of physical security of telecommunications sites, assessing an adversary's task to destroy the infrastructure in general as essentially impossible without resorting to nuclear attack
- o Raised awareness of those Government efforts that enhance the public switched network (PSN) capability to serve NSEP users
- o Identified areas of concern where more attention by the Government could be given
- o Initiated a series of studies of emerging technologies and applications that provide new capabilities in the PSN, and
- o Advised Government on related subjects (e.g., essential line service)

3.1 Recommendation Review and Government Action

The Task Force reviewed reports and recommendations of five NSTAC task forces that had completed their work: the Commercial Satellite Survivability (CSS) Task Force; the Commercial Network Survivability (CNS) Task Force; the Electromagnetic Pulse (EMP) Task Force; the National Coordinating Mechanism Task Force, and the Automated Information Processing (for telecommunications support systems) Task Force. Individual recommendations were reviewed in detail and Government responses identified. Many NSTAC recommendations were identified as accomplished, in progress, or being planned for implementation by the Office of the Manager, National Communications System (OMNCS). The Task Force urged certain NSTAC recommended initiatives be reconsidered by the Government, or receive more emphasis.

The ongoing Task Force review stimulated considerable OMNCS/Task Force dialogue resulting in some Government activity modifications and Government requests for further advice.

3.2 The Evolving Status of TSS with Government Programs

In brief, the Task Force has the following view of the current status of TSS, as it is evolving along with the Government's programmed enhancements:

- o Electric power availability (beyond a few days' emergency backup) is the major survivability issue. A joint Government/NSTAC effort is addressing this issue.
- o EMP effects on network components are under study by the Government, and means to counter the effects are being explored.

- o Commercial SATCOM Interconnectivity (CSI) Program augmentations will soon support the linking of broadly separated PSN communication areas that could become disconnected from each other in postulated nuclear laydowns. The first set of augmentations (telemetry, tracking and control units and earth stations) to allow for communications and control interoperability among "family" C-band satellites during emergencies are in the initial stages of deployment. Assuming future funding of a corresponding augmentation effort for Ku-band satellites, system survivability through interconnectivity will continue as the commercial use of Ku-band expands.
- o Government CNS Program terrestrial interconnects, and NETS Program call controllers for non-traditional routing in damaged networks, are larger efforts and are still in development. CONUS-wide emergency connectivity (to counter nuclear scenario effects) will take several years to accomplish.
- o The prompt establishment of the National Coordinating Center (NCC) put into effect a national coordinating mechanism for NSEP telecommunications. The current National Telecommunications Management System activities of industry and Government address functional redundancy for the NCC and will eventually lead to regional backup capability.

3.3 Areas Requiring Further Study/Action

Some areas of concern to the Task Force remain following the Government actions review:

- o There is no funding to reconnect end users that have become isolated from the backbone network. The eventual funding of CSI Phase II could provide connectivity to both mobile and isolated users, and could link OCONUS users into the NETS network.
- o Reconstitution and maintenance of the network over days, weeks and months will require planning for the survival of automated operational support systems, particularly network management systems.
- o Due to rapid change in commercial telecommunications, the Government must apply new technology more rapidly to minimize the chance for obsolescence at deployment in Government-planned telecommunications programs, and
- o The Government program focuses on war-related scenarios, primarily major nuclear attack. Other threats, e.g. regional disaster, should be given increased attention.

3.4 NSTAC Responses to Government Requests

Increasingly, the Task Force and other NSTAC bodies have provided consultation directly to the OMNCS concerning their ongoing activities in NSEP planning. In one instance, as part of its Government actions review the TSS Task Force recommended, among other items, expediting consideration of Ku-band commercial satellite interconnectivity. Subsequently an OMNCS request that the CSS Task Force be reconvened in order to review the Phase II CSI Architecture was carried out.

More recently, on July 11, 1988 the President requested the NSTAC to help the OMNCS develop a coordinated Government-wide policy on Essential Service Protection. Sometimes referred to as Essential Line Service or Essential Service List (ESL), the feature is offered by some local carriers to ensure that a small proportion of lines receive reduced dial tone delay. The Task Force assisted the OMNCS with drafts of a policy issuance (NCSN 3-1-1) recommending that NCS member organizations obtain ESL if it is offered by their local exchange carrier. The issuance was drafted for consideration by the NCS Committee of Representatives.

ESL has limited availability, and typically is supplied only to local emergency agencies, at little or no additional cost. In the opinion of the Task Force, (1) increased demand may lead to eliminating non-tariffed service; (2) if there are large demands on single local serving entities, conflict could arise, or service effectiveness could be reduced, and (3) there may be an access problem for Federal NSEP users, who may be largely served by PBXs and Centrex. Advising the OMNCS of these problems, the Task Force also sought to assure that the Government understood that ESL priority dial tone would not provide priority treatment end to end. (The latter capabilities for NSEP users could be addressed with new technology applications.)

3.5 Studies on New Technology

The Task Force, at the direction of the IES in February 1987, began a series of new technology investigations. The intent was to assess the impact of new and emerging technologies on the Government's ability to meet its NSEP telecommunications requirements. This assessment would give the Government the opportunity to influence the development of NSEP-related features in the evolving PSN. The first study of the series, focusing on the capability of network management to provide priority treatment of NSEP traffic, was completed in June. A second study, focusing on intelligent networks/virtual networks, is under way.

The Task Force network management report* was approved at the September 1988 NSTAC meeting. This report recommended a series of

*Telecommunications Systems Survivability (TSS) - Network Management, June 21, 1988.

specific actions by Government and industry to meet the Government's needs for priority treatment of NSEP traffic, end to end. Included was a recommendation that Government should contract with industry to form a joint industry/Government network management group to develop such an approach. Features to enable special handling of NSEP calls were identified in the report, including priority dial tone, identification of NSEP calls, increased routing alternatives, and controls to prevent abuse.

The report further recommended that, when the Government accepted the recommendation for a joint group, NSTAC would establish an interim network management subgroup to advise the Government on its development of the network management effort until the joint group is established. To date the OMNCS has identified several concerns that need resolution before the Government can proceed further.

Meanwhile, the study of intelligent networks and virtual networks has begun, with the intent to identify benefits and risks to NSEP telecommunications objectives inherent in this technology. One objective of the study is to focus on how intelligent networks could meet the Government's NSEP needs. An intelligent network is, in general, structured to allow the development and introduction of new and innovative services into the PSN. It would be an appropriate platform to provide, among other things, end-to-end priority treatment for NSEP traffic. To date, an extensive literature search has been undertaken, and briefings have been given to the task force by a half dozen companies.

4.0 NEW TECHNOLOGY, ISSUES AND CAPABILITIES

As mentioned above, the Government should maintain awareness of ongoing technology changes in order to avoid obsolescence of Government program assets at deployment. The NSTAC can be of major assistance in helping to provide this awareness. Moreover, NSTAC can help the Government identify potential new technology applications to serve the developing objectives of the Government.

The commercial telecommunications industry responds primarily to demonstrated market demand. It will not develop NSEP features in telecommunications technology or services unless and until requirements for such features or services are put forward by the Government. If the Government knows what is increasingly technologically feasible, it can call for NSEP-related features to be developed.

Clearly, features of value for NSEP application such as those in the TSS Network Management report can be supported by recent developments in technology. With increasingly capable intelligent networks in the offing, still more features and services will be possible. The conversion to Signalling System No. 7 makes possible the use of stored intelligence in central or centralizable data centers. Upon activation of customized

trigger mechanisms, specialized treatment of NSEP traffic could be implemented, for instance. Also, as the customer can have limited control over the information stored in those data centers, it will be possible, for example, to control private network configurations. Recognizing the distinction between network management technique and management of the network, both Government and industry should include NSEP considerations in all implementation plans.

The Government has not yet formally stated the feature set required to support NSEP telecommunications. When a specific set of NSEP feature requirements is promulgated, industry can respond by developing specialized equipment/software. The proper technological environment for such development already exists.

5.0 TSS TASK FORCE RECOMMENDATIONS

The work begun by the TSS Task Force should transition to the new IES structure. Two dimensions have emerged in past Task Force activities: assessing TSS as a whole and advising the Government on past/ongoing efforts; and looking toward a future, changing, PSN. The Task Force urges the IES, in implementing its new structure, continue by:

- 1) providing advice to Government on NSEP telecommunications planning that is being implemented in ongoing Government programs, particularly those of the Office of the Manager, NCS; and

- 2) providing information on new and emerging technologies that can impact NSEP telecommunications systems survivability, both negatively and positively. In this arena, the study of intelligent networks should continue.

Moreover, the TSS Task Force recommends that:

- 3) the IES report to the NSTAC periodically on the status of the general survivability of the telecommunications system.

